

APPROVAL SHEET FOR SUSPENDED LOAD OPERATIONS

SLO-KSC-1999-001

TITLE TDRS H,I,J / H8601 INTEGRATED SUSPENDED LOAD OPERATION

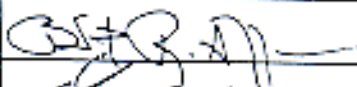
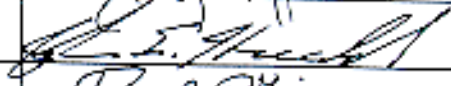
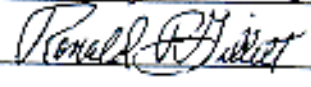
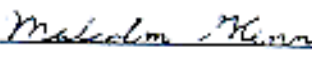
DOCUMENT NUMBER/TITLE CTP-PL-1166 / SC MATE TO PLA - 66 INCH,
CTP-PL-1002 / ENCAPSULATION OPERATIONS

PREPARED BY BRIDGET R. GRIFFIN

DATE 1/19/99

REQUIRED APPROVAL

CONTRACTOR	<input type="checkbox"/> DESIGN	<input type="checkbox"/> R & QA	<input type="checkbox"/> OPERATIONS	<input type="checkbox"/> SAFETY
NASA	<input type="checkbox"/> DESIGN	<input type="checkbox"/> R & QA	<input type="checkbox"/> OPERATIONS	<input type="checkbox"/> SAFETY

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1.0 OPERATION

Tracking and Data Relay Satellite (TDRS) H, I, J (HS601) spacecraft (S/C) lifting and mating operations (see Figure 1).

2.0 SUPPORTING DOCUMENTS

2.1 Applicable Documents

CTP-PL-1166	SC Mate to PLA - 66 Inch (LMA procedure)
CTP-PL-1002	Encapsulation Operations (LMA procedure)
HS601G59297 (CDRL LS-FA-01)	TDRS H, I, J Launch Site Safety Plan (HSC document)
PP80409-H00-002 (CDRL LS-FA-02)	TDRS H, I, J (HS601) Missile System Prelaunch Safety Package (MSPSP) (HSC document)
SAA 01HS11-005	50-Ton Bridge Crane PHSF
SAA 01FS0420-001	20-Ton Bridge Crane SAEF 2

2.2 Reference Documents

KHB 1710.2, Annex G	KSC Safety Practices Handbook
NSS/GO-1740.9	NASA Safety Standard for Lifting Devices and Equipment

3.0 GENERAL DESCRIPTION

The following integrated operations require four Lockheed Martin Astronautics (LMA) personnel, for the purpose of physical guidance, to be directly under the flight hardware, lifting fixture and hydraset during the last stage of a mate (within 1 inch), and the beginning of a lift (first 1 inch).

Case 1 - S/C mating to the Lockheed Martin Atlas Type D, Payload Adapter (PLA). Please note that this operation is also referenced in an approved Hughes Space and Communications (HSC) specific SLOA/A to KSC.

Case 2 - S/C with PLA mating to the LMA ground transport vehicle (GTV).

There is one final integrated operation that requires one Lockheed Martin Astronautics (LMA) and one Hughes Space and Communications (HSC) personnel, for the purpose of critical clearance verifications, to be directly under the flight hardware, lifting fixture and hydraset. These clearance verifications must occur after lifting the S/C off the HSC support stand and prior to mating the S/C to the PLA.

4.0 RATIONALE/ANALYSIS

The S/C suspended load operations comply with the NASA Alternate Safety Standard for Suspended Load Operations because:

Alternate Standard Requirement 1a: The S/C mating/separation ring is smaller in diameter than the outer diameter of the S/C. It is necessary to position LMA personnel beneath the S/C to ensure proper mating, de-mating and lifting in order to prevent damaging the flight mating/separation ring surface.

Alternate Standard Requirement 1b: A secondary support system is not feasible because the S/C mating/separation ring represents the only primary structure interface for the S/C.

Alternate Standard Requirement 1c: The LMA procedures (CTP-PL-1166 and CTP-PL-1002) limit the number of personnel beneath the suspended load to no more than four.

Alternate Standard Requirement 1d: LMA personnel will accomplish the mating, demating and lifting operations as quickly and safely as possible to minimize exposure. Specific procedures listed in section 2.0 will control these operations. For Case 1 and Case 2 mating operations, LMA personnel are only under the load during the last 1 inch prior to mate and for the first 1 inch during lifting.

Alternate Standard Requirement 2 - Suspended load operations are reviewed and approved on a case-by-case/specific need basis - see general description and alternate standard requirement 1.

Alternate Standard Requirement 3 - Only those suspended load operations approved by the Center NASA Safety Assurance Director will be permitted. A list of approved suspended load operations will be maintained by the Center NASA Safety Assurance Directorate.

Alternate Standard Requirement 4: Existing integrated operations procedures are complete and will be used (see Section 2.0).

Alternate Standard Requirement 5 - A new suspended load operation not covered by this SLOAA, deemed necessary due to unusual or unforeseen circumstances where real time action is required, shall be documented and approved by the Center NASA Safety Assurance Director.

Alternate Standard Requirement 6: The suspended load operations covered by this report are performed at the PHSF using the 50-ton bridge crane or at SAEF 2 using the 20-ton bridge crane. The cranes are tested, inspected, maintained and operated in accordance with the NASA Safety Standard for Lifting Devices and Equipment NSS/GO-1740.9.

The cranes are load tested at 100% rated capacity annually and there is a preventative maintenance program to ensure proper operation. The cranes are load tested to 125% rated capacity when new or following a major repair or modification.

The HSC MGSE lift fixture was designed with an ultimate factor of safety of 5.0 times the rated load and proof tested to a factor of 2.0 times the rated load annually. The lift fixture was designed to handle a substantially greater rated load than the maximum expected S/C weight.

When lifting the S/C, the S/C will be connected to the crane with a HSC hydraset and lift fixture. The hydraset will be used for the initial 1 inch of travel during lifting and the final 1 inch of travel during mating. Maximum weight of the S/C is approximately 7000 lbs.

Only HSC crane operators trained and certified by KSC will be allowed to operate the KSC PHSF crane.

An individual will be stationed at the crane main circuit breaker during hoisting to immediately remove power, thus setting the brakes, should a failure occur with the crane controls.

The crane will be operated in a slow-speed mode when the S/C is in close proximity to other hardware.

Alternate Standard Requirement 7: System Assurance Analyses (SAA) have been performed on the PHSF 50-ton bridge crane and the SAEF 2 20-ton bridge crane. Each SAA includes a Failure Modes and Effects Analysis/Critical Items List (FMEA/CIL) and a hazards analysis.

No critical single failure points were identified during this analysis.

Alternate Standard Requirement 8: Pre-operational inspections of the lifting equipment as well as crane functional checks will be performed prior to use. The HSC MGSE lift fixtures have been proof tested, dye penetrant inspected, tagged and will be visually inspected prior to each S/C lift.

Alternate Standard Requirement 9: Only HSC crane operators trained and certified by KSC will be allowed to operate the crane when personnel are beneath suspended loads.

Alternate Standard Requirement 10: Section 2.0 procedures establish appropriate control areas before initiating operations. Only the minimum number of essential personnel (manloaded in procedures) will be permitted in this area.

Alternate Standard Requirement 11: A pre-task briefing and a safety walk down of the control area will be performed immediately prior to each operation to ensure personnel are ready to support.

Alternate Standard Requirement 12: LMA personnel beneath the suspended load will be in voice contact with the HSC crane operator and the LMA system engineer directing the crane operator throughout the operation. At any time during the operation anyone can call a safety hold. The HSC crane operator will have full visual contact with the load throughout the operation.

Alternate Standard Requirement 13: The LMA system engineer, the HSC crane operator and the HSC crane power cut-off switch operator will be in visual contact with the LMA personnel beneath the suspended load throughout the operation.

Alternate Standard Requirement 14 - The Center NASA Safety Assurance Directorate shall conduct periodic reviews to ensure the continued safety of suspended load procedures.

Alternate Standard Requirement 15 - The Center NASA Safety Assurance Directorate will provide copies of approved SLOAAs, a list of approved suspended load operations, a list of cranes/hoists used for suspended load operations and copies of the associated FMEA/CIL and hazards analyses to NASA Headquarters.

Approval:

Date: 2/1/99



Bruce L. Jansen
Acting Director,
Safety Assurance
Kennedy Space Center

Illustrating Personnel Under Suspended Loads (see SLOA/A)

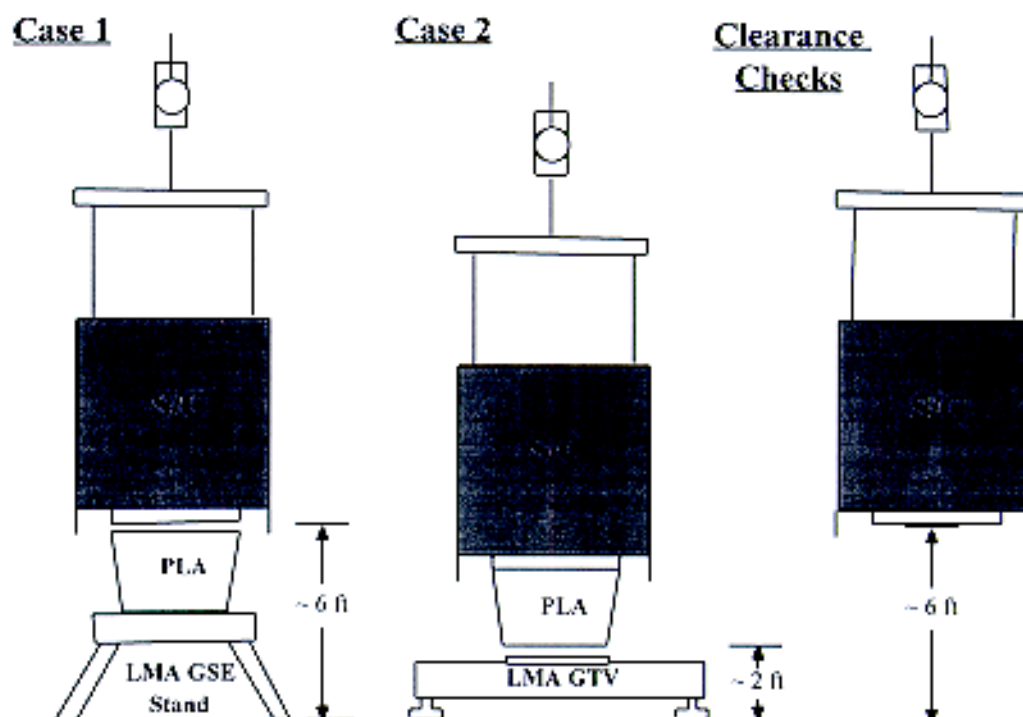


Figure 1 S/C Mating and Lifting Suspended Load Operations